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(54) Vibration prevention handle

(57) A vibration prevention handle can prevent vibration and shock generated from a vibrating device. The handle comprises a small-diameter close-coiled and larger diameter open-coiled helical spring 6, in addition to the conventional handle 4 of the device. One end of the helical spring 6 is fixed to the handle 4, and the other end is movably fitted to the handle through a sleeve 7.

FIG. 2

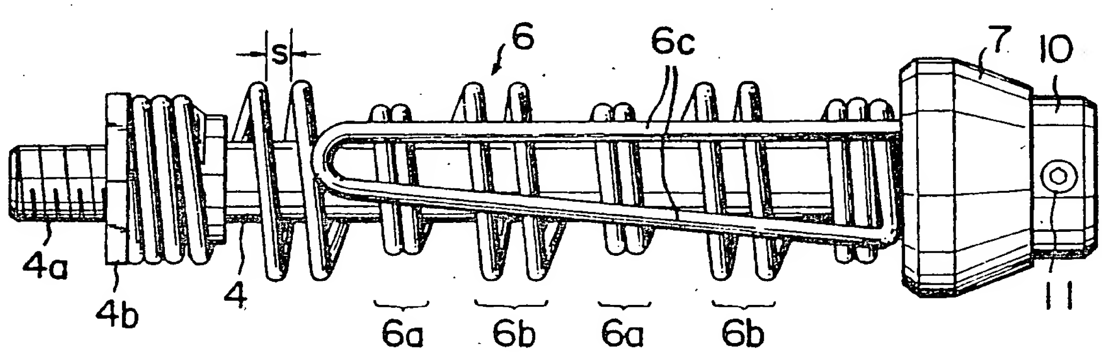


FIG. 1

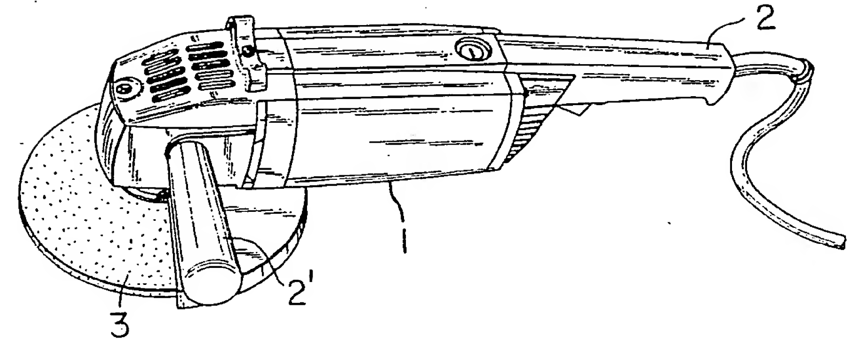


FIG. 5

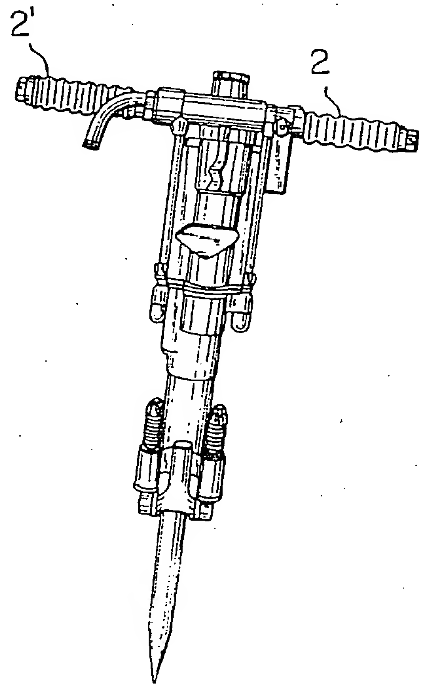


FIG. 2

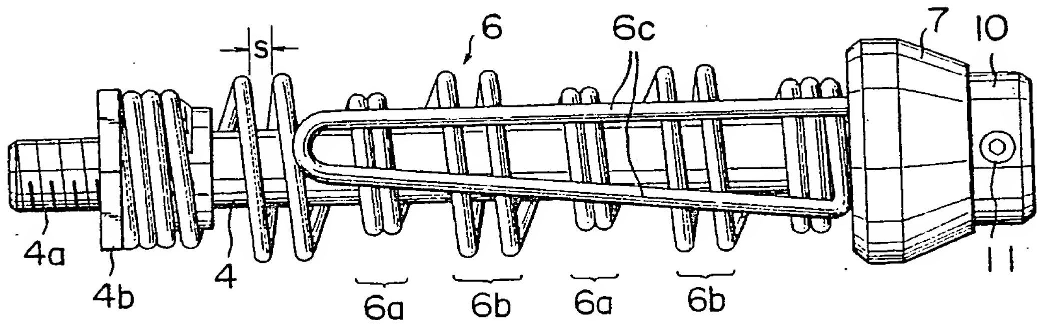

s
6
6c
7
10
4a
4b
4
6a
6b
6a
6b
11

FIG. 3

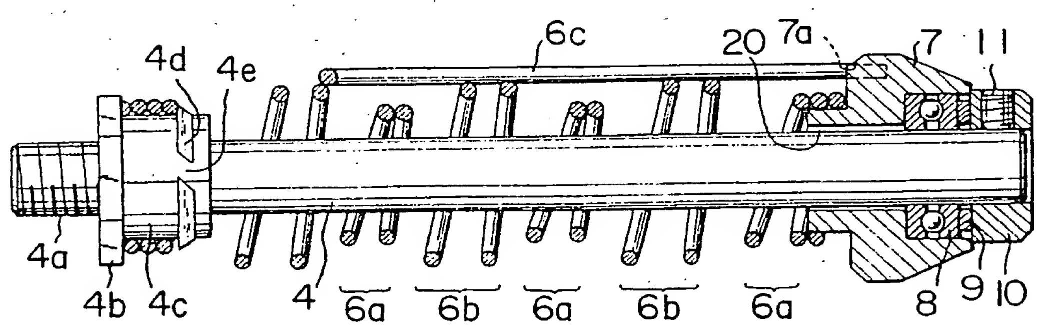

6c
20
7a
7
11
4d
4e
4a
4b
4c
4
6a
6b
6a
6b
6a
8
9
10

FIG. 4(a) PRIOR ART HANDLE

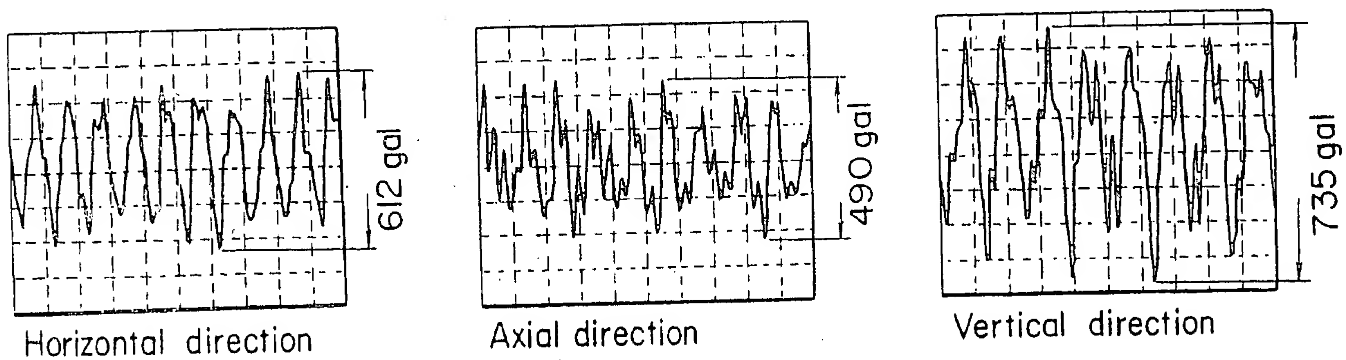
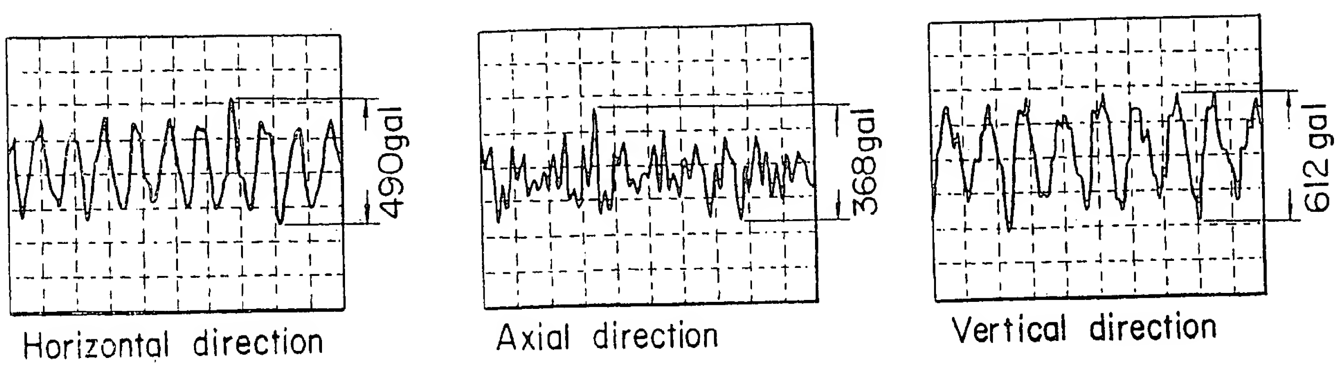


FIG. 4(b)



SPECIFICATION

Vibration prevention handle

The invention relates to vibration-producing devices, for example, disk grinders, and more specifically to a vibration prevention handle for use on such devices.

In a conventional vibrating device, for example, a disk grinder, a handle or a grip is usually provided on either side thereof, as shown in Fig. 1. In this case, the disk grinder is supported by the user gripping the handle 2′ in his left hand and the rear portion 2 in his right hand, or vice versa, and is used by applying the rotating grinder wheel 3 to a workpiece with an appropriate pressure while moving the grinder right and left or back and forth.

In the conventional disk grinder as described above, however, since the grinding angle of the grinder wheel (an angle between the surface of the grinder wheel and a surface of the workpiece which has already been ground by the grinder wheel) changes according to the desired final profile of the workpiece, for instance, in the case of a plane finish, the grinder wheel is moved parallel to the finished surface of the workpiece; in the case of the finishing or cutting of a convex curved surface or an angled surface of an axle, the grinder wheel is required to be held at an appropriate grinding angle. In addition, since the disk grinder ranges from 6 to 7 kg in total weight and the grinder wheel rotates at from 6000 to 7000 rpm, considerable vibration and shock is generated and is transmitted to the worker through the handle, together with a rotational force, whenever the grinder is used for grinding work.

Because no effective countermeasures have been taken until now against such vibration and shock, the conventional disk grinder handle transmits an unbalanced load and vibration and shock to the user's hand and arm especially when the grinder is used with the grinding angle being varied by the user, thus resulting in occupational diseases such as vibration disease or Raynaud's disease (which occurs only in users of vibrating devices). Such diseases are not limited to users of the abovementioned disk grinder, but also affect users of electromotive hammers, impact wrenches, pneumatic concrete breakers, etc.

The above-mentioned vibration disease has the following symptoms:

(1) impaired blood circulation in the hand or arm to which vibration is directly applied;

(2) impaired function of the central nervous system; and

(3) damage to the bones and joints.

It is an object of the present invention to provide a vibration prevention handle for a vibrating device in which vibration and shock generated by the vibrating device can be damped through the resilience of a special helical spring.

The vibration prevention handle according to the present invention comprises a small-diameter close-coiled and large-diameter open-coiled helical spring, one end of which is loosely fitted to a fixed handle, the other end of which is fixedly fitted to the fixed handle.

In addition to the above structure, in the helical spring according to the present invention, a parallel rod portion formed by bending one end of the helical spring is preferably provided in parallel with the axis of the handle along the outer peripheral surface of the helical spring, in order to prevent the worker's hand from slipping in the circumferential or axial direction of the helical spring.

One form of vibration prevention handle according to the present invention will now be described by way of example with reference to Figs. 2 to 5 of the accompanying drawings in which like reference numerals indicate corresponding elements, and in which:

Figure 1 is a perspective view of a conventional disk grinder;

Figure 2 is a plan view of a handle according to the present invention;

Figure 3 is a cross-sectional view of the handle shown in Fig. 2;

Figure 4(a) is a set of graphs showing the accelerations of a conventional handle measured in three directions (axial, horizontal and vertical);

Figure 4(b) is a set of graphs showing the corresponding accelerations of a handle according to the present invention; and

Figure 5 is a perspective view of a hard hammer with the handles according to the present invention.

Referring to Figs. 2 and 3 of the accompanying drawings, a handle shaft (fixed shaft) 4 is arranged to be screwed into a threaded hole in a device such as a disk grinder (not shown). The handle shaft 4 has a threaded portion 4*a* to be screwed into the threaded hole and a hexagonal flange portion 4*b* which can be gripped with a spanner to rotate the shaft. A helical spring 6 is fitted loosely over the outer circumference of the handle shaft 4. The helical spring 6 is formed with alternate small-diameter close-coiled helical spring portions 6*a* and larger-diameter open-coiled helical spring portions 6*b* with an appropriate pitch S; that is to say, the outer diameter of the helical spring 6 changes so as to form portions of different diameters. One end portion of the helical spring 6, which is a small-diameter close-coiled portion, is press-fitted and fixed to a fitting portion 4*c* provided near the hexagonal flange portion 4*b* of the handle shaft 4. On the outer circumferential surface of this fitting portion 4*c*, a tapered stop projection 4*d* is provided with its diameter increasing towards the flange in order to prevent the helical spring 4 fitted to the fitting

portion $4c$ from falling off. A cutout portion $4e$ is provided at a part of the tapered stop projection $4d$; when fitting the spring 6 onto the fitting portion $4c$ one end of the helical spring can be forced through this cutout $4e$ and the spring rotated over the fitting portion $4c$ until the spring is brought into contact with the flange $4b$.

The other end of the spring 6, the right-hand end as seen in Fig. 2, is bent to form a rod portion $6c$ extending straight along and approximately parallel to the handle shaft 4 extending toward the handle fitting end (the left-hand end as seen in Fig. 2) and back towards the outer end of the helical spring 6 so as to form a second parallel rod portion $6c$. The free end of the second parallel rod portion $6c$ is inserted into a locking hole $7a$ provided in an end surface of a resin sleeve 7 rotatably fitted to the outer end of the handle shaft 4. Further, the outer end of the helical spring 6 is brought into contact with the inner end surface of the sleeve 7, and a thrust bearing 8 is provided in the sleeve 7. The thrust bearing 8 is retained under a bias pressure by a set collar 10 through a washer 9. In other words, the helical spring 6 is mounted on the handle shaft 4 under an appropriate compression. The collar 10 is fixed to the end of the handle shaft 4 by the use of a set screw 11. Further, in this embodiment, a number of axially-extending grooves 20 are provided on the inner circumferential surface of the sleeve 7 to improve the damping characteristics of the sleeve 7 against vibration and shock by reducing the friction between the sleeve 7 and the handle axle 4.

Fig. 4(a) shows as an example in graphical form the acceleration (in gal) of a conventional handle in three directions (horizontal, axial and vertical), when the handle is used with a disk grinder. Fig. 4(b) shows as an example in graphical form the acceleration (in gal) of a handle according to the present invention in the same three direction when used with the same disk grinder.

These acceleration data are measured by fixing an acceleration measuring instrument on the handle of the disk grinder.

As may be seen from Figs. 4(a) and 4(b), the peak-to-peak ranges of vibration acceleration of $A\omega^2$ (where A is the amplitude of the vibration and ω is the angular velocity) generated from the handle according to the present invention are smaller than those from the conventional handle in every direction.

Fig. 5 shows a state where the handle of the present invention is fitted to a hard hammer. In this arrangement, two handles 2 and 2′ constructed as described above with rubber covers over them are screwed into respective handle fitting holes provided on either side of the hammer body 12.

As described above, in the vibration prevention handle constructed according to the present invention, since vibration and shock emanating from the body of a vibrating device like a grinder are effectively damped, it is possible to protect the user's hand and arm from vibration disease. Additionally, the variable outer diameter of the helical spring can prevent the hand from slipping along the handle; the parallel rod portion formed by bending one end of the helical spring can prevent the hand from slipping round the handle and assure a firmer grip; the helical spring, one end of which is rotatably fixed to the sleeve, can prevent the hand from slipping off the grip position and assure a stabler grip because the sleeve can rotate with the helical spring, even if a torsional force is applied to the handle shaft in use. Therefore, operator fatigue can be reduced, leading to safer work, thus promoting productivity and work quality.

The vibration prevention handle according to the present invention is usable with superior damping characteristics for various vibration devices which generate vibration and shock, such as electromotive hammers, impact wrenches, pneumatic drills, and so on, as well as disk grinders.

CLAIMS

1. A vibration prevention handle, which comprises: a handle; a helical spring having at least one small-diameter close-coiled portion and at least one larger-diameter open-coiled portion so arranged as to surround the handle, one end of the helical spring being movably fitted to the handle, the other end of the helical spring being fixedly fitted to the handle.

2. A vibration prevention handle as claimed in claim 1, which comprises: a flange for supporting one end of the helical spring; and a tapered stop projection with a cutout for fixedly supporting the helical spring at one end of the handle.

3. A vibration prevention handle as claimed in claim 2, wherein the helical spring is forcedly passed through the cutout while being rotated until the helical spring is brought into contact with the flange.

4. A vibration prevention handle as claimed in any one of claims 1 to 3, wherein the helical spring comprises at least one larger-diameter open-coiled helical spring portion.

5. A vibration prevention handle as claimed in any one of claims 1 to 4, wherein the helical spring comprises a parallel rod portion formed by bending one end portion of the helical coil parallel to the axis of the handle along the outer peripheral surface of the helical spring.

6. A vibration prevention handle as claimed in any one of claims 1 to 5, which further comprises a sleeve for loosely fitting the helical spring to the handle, the sleeve being rotatably fitted to the handle at one end

of the handle, a smaller diameter cylindrical portion of the sleeve being inserted into the inner space of the helical spring, the end of the parallel rod portion being held in a hole provided in the sleeve.

7. A vibration prevention handle as claimed in claim 6, which further comprises a thrust bearing for reducing the friction between the sleeve and the handle, the thrust bearing being within the sleeve.

8. A vibration prevention handle as claimed in claim 6 or claim 7, wherein the sleeve is made of resin.

9. A vibration prevention handle as claimed in claim 7 or in claim 8 when dependent upon claim 7, which further comprises a set collar for fixing one side of the thrust bearing.

10. A vibration prevention handle as claimed in any one of claims 1 to 9, wherein the helical spring covering the handle is so arranged as to be under an appropriate compression force.

11. A vibration prevention handle as claimed in any one of claims 1 to 10, wherein the handle is provided with a threaded portion for attaching it to the body of a vibration-producing device.

12. A vibration prevention handle claimed in claim 2, wherein the said flange is hexagonal in shape for engagement by a spanner for mounting the handle on a vibration-producing device.

13. A vibration prevention device substantially as hereinbefore described with reference to, and as shown in, Figs. 2 and 3 of the accompanying drawings.

14. A device that in use produces vibrations and is fitted with, and so arranged that it can in use be held by, one or more handles as claimed in any one of claims 1 to 13.

15. A device as claimed in claim 14, which is a hammer substantially as hereinbefore described with reference to, and as shown in, Fig. 5 of the accompanying drawings.

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